ADJUSTABLE LENGTH CONNECTION ARM FOR A MAGNETIC CONSTRUCTION TOY

FIELD OF INVENTION

This invention relates to connection arms in a magnetic construction toy for building geometrical structures.

BACKGROUND OF THE INVENTION

Connection arms in magnetic construction toys are rigid structures generally having magnets at the arm extremities for coupling with magnetizable bodies to form a geometric sculpture. The sculpture shape may be modified by replacing one of or a multiplicity of individual connecting arms with either longer or shorter connecting arms thereby creating a new visual impression. To modify the sculpture, therefore, requires the removal of a connecting arm that has a fixed length and replacement of that arm with one of a longer or shorter fixed length. Thus, the sculpture must be disassembled in part in order to create a modified visual impression and in some instances completely disassembled. Magnet bearing connecting arms in the prior art are rigidly constructed and because of their fixed length, limit the types of toy geometrical sculptures possible with fixed length connection arms. Also, the physical number of connection arms of varying length to permit a wide variety of sculptures substantially increases the costs associated with the manufacture and sale of magnetic construction toys.

It is therefore desirable to have connection arms that are adjustable in length to permit the original sculpture to be modified without disassembling the structure and thus permit a variety of visual impressions to be easily created without replacing or disconnecting any of the connecting arms defining the sculpture.

SUMMARY OF THE INVENTION

There is, therefore, provided according to the present invention, a magnetic construction toy having connecting arms that are adjustable in length either before, during, or after a geometrical structure is built.

The present invention is directed to a magnetic construction toy having adjustable length connection members. In the preferred embodiment, the connection member consists of a first member having a distal end, a proximate end, and a longitudinal axis. A magnet is captively carried by the first member adjacent its distal end for magnetically coupling with a magnetizable body preferably having a spherical shape. The connection member includes a second member that has a first end, a second end, and an axis of elongation where the axes of the first and second members are collinear when the members are assembled. The first and second members when assembled are so mounted to permit relative telescopic movement between the first and second members such that the first member may be selectively displaced bi-axially with respect to the second. A magnet is also captively carried by the second member adjacent the second end for magnetically coupling with a magnetizable body. The axial distance, in the embodiments of this invention , between the distal end of the first member and the second end of the second member, is selectively adjustable by an adjustment means associated with both members where the adjustment means is responsive to an external force.

In the preferred embodiment, the adjustment means contains a latch that is carried by the first member a fixed axial distance from its distal end and located intermediate the distal and proximal ends of the member. The latch is radially displaceable with respect to the first member and biased by the resilience of the first member to return to a captive position with respect to the second member. The second member has an axially extending void therein for telescopically receiving the first member and an axially extending passage, communicating with the void, for receiving the latch and permitting axial movement of the latch when sufficiently displaced radially with respect to the second member. A multiplicity of axial spaced and laterally extending openings communicate with the passage and the void; each of the openings is so dimensioned and proportioned to captively hold the latch in fixed relationship with the second member to preclude axial displacement of the latch. Upon sufficient radial displacement of the latch, the latch is released form captive engagement with the opening, such release permits the latch to be axial displaced to another opening thereby permitting the axial length between the distal end of the first member and the second end of the second member to be selectively adjustable.

In another embodiment, the adjustment means consists of external threads extending at least in part axially between the distal and proximate ends of the first member that engage internal threads extending at least in part axially of the first and second ends of the second member. An external torque applied to the first or second members will cause axial translational movement of the members with respect to each other which permits the distal end of the first member to be selectively moved bi-axially with respect to the second member. The external thread of this embodiment is preferred to be a worm thread for engagement with the internal worm threads of the second member to provide frictional resistance to relative movement of the first and second members after the members are positioned to a selected axial length between their respective distal and second ends.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and advantages will become appreciated as the same become better understood with reference to the following specification, the claim and drawings wherein:

FIG. 1 is a perspective view of an embodiment of the adjustable length connection member of this invention in an assembled configuration.

FIG. 2 is a perspective view of the embodiment of this invention shown in FIG. 1 illustrating the first and second members of the adjustable length connection member.

FIG. 3 is a top view of the second member shown in FIG. 2.

FIG. 4 is a cross-sectional view taken along the line B-B as shown in FIG. 3.

FIG. 5 is a side elevational view of FIG. 3.

FIG. 6 is a cross-sectional view taken along the line D-D as shown in FIG. 3.

FIG. 7 is a rear view taken along line E-E as shown in FIG. 3.

FIG. 8 is a front view taken along the line F-F as shown in FIG. 3.

FIG. 9 is a top view of the first member of the adjustable length member illustrated in FIG. 2

FIG. 10 is a cross-sectional view taken along the line H-H as shown in FIG. 9.

FIG. 11 is a side-elevational view of FIG. 9.

FIG. 12 is a cross-sectional view taken along the line J-J as shown in FIG. 10.

FIG. 13 is a front view taken along the line K-K as shown in FIG. 10.

FIG. 14 is an exploded perspective view of another embodiment of this invention illustrating the first and second members of the adjustable length connection member.

FIG. 15 is a partial cross-sectional side view of the adjustable length connection member in an assembled configuration.

FIG. 16 is a perspective view of a geometrical sculpture constructed with the adjustable length connection member illustrated in FIGS. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13.

DETAILED DESCRIPTION

FIG. 1 is a perspective view of the preferred embodiment of this invention and illustrates an adjustable length connection arm **1** for a magnetic construction toy. The length adjustable connection arm **1** is composed of a first member **2** and a second member **3** which are mounted in telescopic slidable relationship to permit relative bi-axial movement of first member **2** with respect to second member **3**. FIG. 2 illustrates first member **2** and second member **3** before being assembled.

Referring to FIG. 2, it can be seen that first member **2** has a longitudinal axis **4** and that second member **3** has an axis of elongation **6**, where their respective axes are co-linear when the members are assembled. Adjacent its distal end **7**, first member **2** captively carries a first magnet **8** for magnetically coupling with a magnetizable body **9** in constructing a geometrical sculpture (shown in FIG. 16).

In the preferred embodiment, first member **2** is made of a hard plastic material having sufficient resiliency to maintain a nominal equilibrium shape; however, a metallic material or other material having the property of resiliency to return to a nominal shape may also be used in the construction of either first member **2** or second member **3** or both.

The adjustable length connection arm of the of the preferred embodiment is selectively positionable to a predetermined length by the apllication of an external force to latch **12** that is carried by first member **2** at a fixed distance intermediate its distal and proximate end. Intermediate distal end **7** and proximate end **11** of first member **2**, the latch **12** is carried by first member **2** at a fixed axial distance from distal end **7**. Extending laterally from latch **12**, as can further be seen in FIG. 9, latch **12** is abutted by shoulders **13** and **14** which are integral with latch **12**. By radially depressing latch **12** from its nominal equilibrium position, latch **12** permits first member **2** to be selectively positioned with respect to second member **3** by sliding axially in telescopic relationship to a pre-determined location thereby selectively adjusting the axial distance of distal end **7** from second end **22** of second member **3**. In the preferred embodiment, a longitudinal slit **16** extends axially from proximate end **11** of first member **2** and laterally; slit **16** permits latch **12** to be radially depressed by an external force such that the latch is resiliently biased to return to its nominal equilibrium position shown in FIG. 2. As can

be seen in Fig.2, slit **16** communicates with proximate chamber **17** which extends at least in part axially through first member **2**; FIGS. 12 and 13 illustrate proximate chamber **17** communicating with slit **16** and in FIGS. 10 and 11, it can be seen that slit **16** extends at least in part axially from proximate end **11** of first member **2**. The external structure of first member **2** adjacent distal end **7** is shown in FIG. 2 and FIG. 10. Both figures illustrate a conical taper **18** that partially envelopes first magnet **8** adjacent distal end **7** and that first magnet **8** is captively held within distal end **7**.

By referring to FIG. 2, the structure of second member **3** can be seen to have an axially extending void **19** that is open at first end **21**; Void **19** is cylindrically shaped and extends at least in part axially in the direction of second end **22**. Adjacent second end **22**, second magnet **23** is captively held within second member **3** which permits magnetic coupling with spherically shaped magnetizable body **9** (shown in FIG. 16). A conical taper **26** surrounds second magnet **23** at second end **22** as illustrated in FIG. 4. To permit latch **12** to be positioned axially with respect to second member **3**, passage **24** communicates with axially extending void **19** and is also open at first end **21** which permits latch **12** and consequently first member **2** to be advanced bi-axially with respect to second member **2**. Axially spaced openings **27** communicate with both axially extending void **19** and passage **24**. Openings **27** are so dimensioned and proportioned that when sufficiently engaged by latch **12**, latch **12** will be so held within opening **27** that further axial movement of first member **2** relative to second member **3** will be precluded. In the preferred embodiment, the multiplicity of openings **27** that communicate with passage **24** and axially extending void **19** are opposed serrations **28** and **29**. however, openings **27** may be laterally extending slots communicating with void **19** and passage **24** or of other configurations so dimensioned and proportioned to captively hold latch **12**.

Thus, to selectively adjust connection arm **1** in the preferred embodiment as shown in FIGS. 1-13, when first member **2** is in telescopic engagement with second member **3**, latch **12** will be positioned in passage **24** and aligned for bi-axial displacement relative to second member **3**. By sufficiently displacing latch **12** in a radial direction against the resilient bias force exerted by the cantilever displacement of first member **3** as permitted by slit **16**, latch **12** is released from captive engagement opening

27; this permits latch **12** to be axially moveable with respect to second member **3** along passage **24**. Any one of the multiplicity of openings **27** which are so dimensioned and proportioned to captively hold latch **12** may be selected to position latch **12** and consequently the axial distance between distal end **7** of first member **2** and second end **22** of second member **3** may be selectively determined. As is evident from the foregoing description, when latch **12** is in its nominal equilibrium position and in engagement with any opening **27**, it will be captively held thus precluding bi-axial movement of first member **2** with second member **3**.

Another embodiment of this invention is shown in FIGS. 14 and 15. In this embodiment, adjustable length connecting arm **1^1**, and as in the embodiment described above, consists of a first member **2^1** and a second member **3^1** where first member **2^1** has a longitudinal axis **4^1** and second member **2^1** has an axis of elongation **6^1**. FIG. 14 illustrates the embodiment before assembly and it can be seen that when assembled, axis **4^1** and axis **6^1** are co-linear.

As in the preferred embodiment, first member **2^1** has a distal end **7^1**, and a first magnet **8^1** where first magnet **8^1** is captively carried within the first member adjacent its distal end **7^1**. Distal end **7'** is also tapered conically as distal end **7** in the preferred embodiment and surrounds first magnet **8'**. The conical taper 18^1 is a preferred structural end for first member **2'**, however other designs such as a pyramid taper would be suitable. Likewise, second member **3^1** has a first end **21^1**, a second end **22^1**, a conical taper **26^1**,and a second magnet **23^1**, captively carried, as shown in FIG. 15 adjacent second end **22^1**. Second member **3^1** has an axially extending void **19'** and is internally threaded with threads **20^1** so dimensioned and proportioned to engage external threads **5^1** (as can be seen in FIG. 15) to permit relative axial displacement between first member **2^1** and second member **3^1**. In the illustrated embodiment of FIG. 15, external threads **5^1** are worm threads and internal threads **20^1** are also worm threads which when engaged provide sufficient frictional resistance to preclude relative movement between first member **2^1** and second member **3^1** bi-axially after first member **2^1** has been translated axially with respect to second member **3^1**. The threads, however, may be of other configurations to permit axial displacement of first member **2^1** with respect to second member **3^1** and so constructed to permit sufficient frictional resistance to oppose axial

movement after first member $\mathbf{2^1}$ and second member $\mathbf{3^1}$ have been selectively positioned relative to each other to a pre-determined axial distance between distal end $\mathbf{7^1}$ and second end $\mathbf{22^1}$.

While I have shown and described embodiments of an adjustable length connecting arm for a magnetic construction toy, it is to be understood that the invention is subject to many modifications without departing from the scope and spirit of the claims as recited herein.